



Influence of basic need satisfaction, teacher self-efficacy, work-experience of teachers: Twenty-first-century skills instruction

 **Nirmala Sebastin Horta**^{1*}

 **Anjali Majumdar**²

 **Priyadarshini MS**³

 **Janis Maria Antony**⁴

^{1,2,3,4}School of Psychological Sciences, CHRIST University, India.

¹Email: nirmala.hs@res.christuniversity.in

²Email: anjali.majumdar@christuniversity.in

³Email: priyadarshini.ms@christuniversity.in

⁴Email: janis.maria@christuniversity.in



(+ Corresponding author)

ABSTRACT

Article History

Received: 15 September 2025

Revised: 27 January 2026

Accepted: 17 February 2026

Published: 12 March 2026

Keywords

Basic need satisfaction
Instruction of twenty-first-century skills
Self-determination theory
Teacher self-efficacy
Twenty-first-century skills.

The purpose of this study is to examine the influence of basic need satisfaction (BNS) and teacher self-efficacy (TSE), as well as work experience, on instructional outcomes related to twenty-first-century skills in schools. The rapidly evolving global landscape necessitates those teachers integrate twenty-first-century skills into classroom instruction. Despite a few studies on teachers' ability to integrate innovative skills in instruction, limited empirical evidence exists regarding the influence of intrinsic motivation on the instruction of innovative pedagogical skills. Guided by Self-Determination Theory and Social Cognitive Theory, a conceptual model is developed to guide the influence on the instructional framework of twenty-first-century skills. Data are collected from 658 secondary school teachers across the southern states of India. For data collection, the study uses standardized instruments: the Teacher Sense of Efficacy Scale, the Basic Need Satisfaction at Work Scale, and the Twenty-First-Century Teaching and Learning Survey. The results of correlation, mediation, and moderation analyses have addressed the objectives of the study. Teacher self-efficacy shows different types of mediation effects on various components of basic need satisfaction, autonomy, competence, and relatedness, in its association with the instruction of twenty-first-century skills, which emphasizes their differential importance. Furthermore, work experience shows no moderation effect, suggesting the need for professional support for all teachers, regardless of experience.

Contribution/Originality: This study contributes to the existing literature by emphasizing the interconnected role of teachers' basic need satisfaction, teacher self-efficacy, and instruction of twenty-first-century skills, where teacher self-efficacy acts as a mediator. Its originality lies in the identification of the differential influence of teacher self-efficacy on psychological needs, autonomy, competence, and relatedness.

1. INTRODUCTION

Globally, the education system has undergone remarkable changes in instructional strategies, with a paradigm shift from traditional teacher-centered approaches to technology-integrated, inquiry-driven, student-centered learning (Keiler, 2018). In this shift, active engagement of learners has become essential for knowledge construction and higher-order thinking, rather than passive absorption of information (Owens, Sadler, Barlow, & Smith-Walters, 2020). Twenty-first-century education thus necessitates instructional practices that nurture learners' active engagement in every stage of learning.

The concept of twenty-first-century skills emerged to address the evolving social and economic needs of a globalized world. Several international organizations, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Organization for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), and the Partnership for 21st Century Skills (P21), have developed frameworks to guide educational systems in aligning curricula and pedagogy with modern skill requirements (Hodge, Holford, Milana, Waller, & Webb, 2021).

In alignment with this global vision, India has introduced several reforms and teacher training initiatives aimed at fostering twenty-first-century skill competencies. The main initiatives, such as Atal Tinkering Labs (Gupta, 2019), DIKSHA-digital infrastructure for knowledge sharing (Kumar & Selva Ganesh, 2022), PM e-VIDYA, and NISHTHA -National Initiative for School Heads' and Teachers' Holistic Advancement (Sharma & Pattanayak, 2022), have aimed to strengthen teachers' pedagogical and digital capacities. Moreover, UNESCO's Mahatma Gandhi Institute of Education for Peace and Sustainable Development (MGIEP) has promoted social-emotional and digital pedagogies (Mochizuki & Vickers, 2024; Singh, Adebayo, Saini, & Singh, 2021). Despite these structural and policy-driven supports, the effective classroom translation of twenty-first-century skills remains inconsistent, often depending on teachers' attitude, readiness, and intrinsic motivation.

Implementing innovative pedagogies demands cognitive flexibility, emotional stability, and continual intrinsic motivation (Ssemugenyi, 2023; Starkey, 2019). Teachers' internal psychological resources are therefore crucial for developing and delivering twenty-first-century learning experiences (Fitriati, Rosli, Iksan, & Hidayat, 2024; Wang, Zeng, & King, 2025). Secondary school level is where students transition to the formal operational stage of cognitive development, and critical and analytical thinking begins (Davis, 2003). Teachers hold a central position at this level. At this point, teachers must foster creativity, problem-solving, communication, and teamwork in young learners. Psychological processes such as motivation, efficacy, and self-concept play an important role in shaping teaching practices (Stroh, Mention, & Duff, 2023).

Self-Determination Theory explains how motivation functions through the satisfaction of three basic psychological needs (autonomy, competence, and relatedness), which are crucial for individuals' effectiveness and well-being in the workplace. In educational contexts, satisfying these needs enhances teachers' instructional motivation and professional fulfillment. Empirical studies show that autonomy in instructional decision-making strengthens teachers' pedagogical self-efficacy (Kulakow, 2020), competencies enhance teaching confidence (Amhag, Hellström, & Stigmar, 2019; Lauermaann & ten Hagen, 2021), and relatedness fosters a sense of collective efficacy and emotional support among colleagues (Matteucci, Guglielmi, & Lauermaann, 2017; Pyhältö, Pietarinen, & Soini, 2015). While these needs were examined individually, empirical evidence remains scarce in exploring the overall influence of basic need satisfaction on teachers' instructional effectiveness. Understanding this combined effect is vital, as earlier research has often conceptualized motivation as an outcome of need satisfaction without examining its behavioral manifestation in classroom practices, particularly in the context of twenty-first-century skill instruction.

Social Cognitive Theory explains the central role of self-efficacy in shaping human behavior (Bandura, 1991). Within educational settings, teacher self-efficacy (TSE) refers to teachers' beliefs about their ability to manage the classroom, engage students, and implement effective instructional strategies (Perera, Calkins, & Part, 2019). Teachers with higher self-efficacy are more confident in implementing innovative and student-centered pedagogies necessary for twenty-first-century learning (Kholifah et al., 2023). Evidence also suggests that basic need satisfaction influences job satisfaction through the mediation of general self-efficacy (Meng, 2022), and teachers' self-efficacy is closely related to general self-efficacy (Ramakrishnan & Salleh, 2018). These findings support the notion that teacher self-efficacy may function as an intermediary mechanism linking basic need satisfaction and teachers' instructional practices.

Work experience is another important factor that affects teachers' effectiveness. According to research, the more experienced teachers are, the better their pedagogical knowledge and classroom management (Ravanal, Ottogalli,

López-Cortés, Alarcón Barraza, & Amórtegui Cedeño, 2025). Experience, though, has a multifaceted effect. While some studies show that experience enhances intrinsic motivation and performance (Layek & Koodamara, 2024), others suggest that experienced teachers may resist innovative pedagogies or technology-driven practices (Bukhari, Jamali, Larik, & Chang, 2023; Täht, Mikkor, Aaviste, & Rozgonjuk, 2024). This duality suggests that work experience may moderate the relationship between psychological factors and instructional behavior, with novice and experienced teachers differing in adaptability to student-centered and technology-enhanced teaching.

It is assumed that basic need satisfaction influences self-efficacy, which in turn may affect teacher self-efficacy and subsequently impact teachers' capacity to implement twenty-first-century skill instruction. Moreover, given that teacher job satisfaction and self-efficacy are positively associated with innovative teaching practices (Esman, Bual, & Madrigal, 2023), the mediating role of self-efficacy is theoretically reasonable. However, empirical research rarely examines the combined effects of these psychological factors together with work experience in a single model. This study addresses this research gap by examining the interconnected relationship between basic need satisfaction, teacher self-efficacy, and teachers' instructional practices for twenty-first-century skills, with work experience as a potential moderator. A correlational mediation-moderation model was developed to examine these relationships.

1.1. Research Hypotheses

To guide the current descriptive study, the following hypotheses were formulated.

H₁: Basic need satisfaction positively correlates with teacher self-efficacy and instruction of twenty-first-century skills among secondary school teachers.

H₂: Teacher self-efficacy mediates the relationship between basic need satisfaction and teachers' instruction of twenty-first-century skills among secondary school teachers.

H₃: Work experience moderates the relationship between basic need satisfaction and teachers' instruction of twenty-first-century skills, such that the strength of the relationship differs across levels of work experience among secondary school teachers.

2. METHODS

2.1. Research Design

This study employs a cross-sectional, descriptive correlational design to explore the research questions. This method is appropriate because it facilitates the collection of a large dataset within a short period. The study aims to capture teachers' current perceptions and behaviors, which do not require longitudinal tracking. Secondary school teachers from the southern states of India participated, as it was feasible and easily accessible for the researchers, and convenience sampling was used to collect data. The use of convenience sampling is primarily because the subjects of the study are drawn from a finite population, which may not necessitate the inclusion of every subject. Additionally, it is impractical to use randomized controlled trials, as they require several hierarchical permissions and approvals, as well as the availability of teachers. Even when teachers meet the inclusion criteria, their voluntary participation is essential for the study (Etikan, Musa, & Alkassim, 2016). This methodological approach systematically analyzes the relationships between psychological factors and instructional practices while adhering to ethical research standards.

2.2. Population and Sample

Samples were selected only from the southern states of India, Andhra Pradesh, Karnataka, Kerala, Telangana, and Tamil Nadu, for geographical proximity to the researchers. Before data collection, permission was sought from the school heads of each participating school to involve their teachers in the study. The study included secondary school teachers who fulfilled the inclusion criteria of teaching Mathematics, Science, Social Sciences, or Languages in English-medium schools under private or semi-government management. About 39 secondary schools were represented in the study, with the participation of 675 teachers. The data collection tool was distributed to 675

teachers from selected secondary schools, who volunteered to participate. About 658 participating teachers returned the data collection tools as fully completed. Table 1 summarizes the participants' features of the sample group.

Table 1. Teachers' distribution for the demographic characteristics.

Demographic characteristics	Category	Counts	Percentage of total
State	Karnataka	208	31.6
	Kerala	127	19.3
	Telangana State	125	19.0
	Tamil Nadu	109	16.6
	Andhra Pradesh	89	13.5
Location	Urban	517	78.6
	Rural	83	12.6
	Sub Urban	58	8.8
Qualification	Post-Graduation with teacher training	174	26.4
	Graduation with teachers training	139	21.1
	Post-Graduation without teacher training	301	45.7
	Graduation without teacher training	44	6.7
Subject	Language	224	34.0
	Science	204	31.0
	Social Sciences	125	19.0
	Mathematics	105	16.0
Gender	Women	565	85.9
	Men	93	14.1
Experience	Less than 5 years	80	12.2
	6 - 10 years	174	26.4
	11 - 20 years	263	40.0
	More than 21 years	141	21.4
Age	22 - 30 years	61	9.3
	31 - 40 years	232	35.3
	41 - 50 years	246	37.4
	51 - 60 years	119	18.1

2.3. Instruments

Data were obtained through demographic information form and three standardized scales, namely, (i) Teachers' Sense of Efficacy Scale (TSES) (Tschannen-Moran & Hoy, 2001); (ii) Basic Need Satisfaction at Work Scale (BNS-W) (Van Den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010); and (iii) 21st Century Teaching and Learning Survey (WVDE-CIS-28) (Hixson, Ravitz, & Whisman, 2012).

2.3.1. Demographic Information Form

The researcher-made demographic information form is given to the participants. They gather details like gender, age, experience, subject details, educational qualifications, and location for analysis.

2.3.2. Teachers' Sense of Efficacy Scale (TSES) (Tschannen-Moran & Hoy, 2001)

The teachers' sense of efficacy scale (TSES) was developed by Tschannen-Moran and Hoy (2001), with 12 items describing 3 factors. Each factor consists of 4 questions designed as items. The factors for efficacy are as follows: classroom management, instructional strategies, and students' engagement. For each item, participants respond to a Likert-type 9-point scale ranging from 1, "not at all," to 9, "a great deal," to rate their self-efficacy for 12 teaching-related tasks.

A preliminary validation was conducted to assess the consistency of the TSE scale's factor loadings and confirm its applicability in the Indian context. Jamovi version 2.4.11 was used to obtain maximum-likelihood estimates of

confirmatory factor analysis (CFA) and to evaluate how well the data fit the original measurement model. The goodness-of-fit indices can be assessed using several metrics. The results of the present study ($\chi^2 = 170$, $df = 51$, $p < 0.001$, CFI = 0.933, TLI = 0.913, RMSEA = 0.0595) suggest that the three-factor model fits the data well, as previous studies have indicated acceptable values for excellent model fit, with CFI and TLI values of at least .90 and .95 respectively, and RMSEA values below 0.06 and 0.08 (Kline, 2023; Schreiber, Nora, Stage, Barlow, & King, 2006). Factor loadings of the TSE items ranged from 0.0497 to 0.0695, further supporting a good model fit. Detailed CFA results are presented in Table 2.

Table 2. Fit indices for measurement models of 21CTL, BNS, TSE (N=658).

Scales Used	χ^2	df	χ^2/df	p	CFI	TLI	SRMR	RMSEA (90% CI)	AIC	BIC
TSE Original	170.0	51	3.33	< 0.001	0.933	0.913	0.0380	0.0595 (0.0497, 0.0695)	27227	27402
BNS Original	827.0	132	6.26	< 0.001	0.620	0.559	0.0797	0.0894 (0.0836, 0.0953)	27500	27756
BNS Refined	85.6	41	2.08	< 0.001	0.945	0.926	0.0325	0.0407 (0.0285, 0.0528)	15291	15452
21CTL Original	2625.0	1006	2.60	< 0.001	0.863	0.853	0.0464	0.0494 (0.0471, 0.0518)	86021	86780
21CTL Refined	1604.0	712	2.25	< 0.001	0.905	0.896	0.0430	0.0436 (0.0408, 0.0465)	73222	73887

Note: CFI-Comparative Fit Index, TLI-Tucker Lewis Index, SRMR-Standardized Root Mean Square Residual, RMSEA-Root Mean Square Error of Approximation, AIC-Akaike Information Criterion, BIC-Bayesian Information Criterion.

Tschannen-Moran and Hoy (2001) established good Cronbach's alpha reliabilities of 0.81 (CM), 0.86 (IS), and 0.86 (SE) in the scale validation study. In the current study, Cronbach's alpha reliability coefficients were .568 (CM) subscale, .702 (IS) subscale, and .607 (SE), whereas the overall TSE scale demonstrated good internal consistency with an alpha of .830 (TSE). It is shown in Table 3.

2.3.3. 21st Century Teaching and Learning Survey (WVDE-CIS-28) (Hixson et al., 2012)

21CTL measure has 48 items, with 8 sub-domains using the 5-point Likert scale. It is designed to elicit both practices and reflections for each subscale separately, but this study elicits information about practices. Critical thinking, collaboration, communication, creativity and innovation, self-direction, global connections, local connections, and usage of technology skills are categorized under twenty-first-century skills in different sections. Furthermore, each section of the survey includes both a definition of the skill and a list of related practices. The items related to practice are rated as follows: 1 for 'Almost Never', 2 for 'A few times a semester', 3 for '1-3 times per month', 4 for '1-3 times per week', and 5 for 'Almost daily'.

A validation was conducted to assess the consistency of the 21CTL scale's factor loading before its use in evaluating twenty-first-century skill instruction among Indian teachers. The initial CFA results indicated that item 3 ("Summarize or create their own interpretation of what they have read or been taught?") of critical thinking, item 2 ("Work with other students to set goals and create a plan for their team?") of collaboration, item 6 ("Use specific criteria to assess the quality of their work before it is completed?") and item 7 ("Use peer, teacher or expert feedback to revise their work?") of self-direction, item 1 ("Study information about other countries or cultures?") of global connect, item 1 ("Investigate topics or issues that are relevant to their family or community?") of local connect, and items 7 ("Use technology to interact directly with experts or members of local/global communities?") and 8 ("Use technology to keep track of their work on extended tasks or assignments?") of using technology were the detected items of the scale with correlational residual values greater than 1, indicating poor fit due to items of similar meaning (Bandalos, 2021). The removal of eight items from the original scale improved the model fit for the remaining 40 items. This represented a substantial improvement over the earlier scale. The Chi-Square (χ^2) decreased from 2625 to 1604, and the degrees of freedom (df) dropped from 1006 to 712. Other fit indices, such as the root mean square

error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis's index (TLI), also showed improvement, with values changing from .0494 to .0436 (RMSEA), .863 to .905 (CFI), and .853 to .896 (TLI), respectively. This resulted in a modified 40-item version suitable for twenty-first-century teaching and learning, which fits the data well. The CFA results are presented in Table 2.

The scale demonstrated excellent reliability, 0.940 in previous studies (Ravitz, 2014). In the present study, the Cronbach's α reliability coefficients for the eight factors ranged from 0.677 to 0.879, indicating good internal consistency for the items within each subscale and an overall reliability of 0.929 shown in Table 3.

2.3.4. Basic Need Satisfaction at Work Scale (BNS-W) Van Den Broeck et al. (2010).

The original scale of psychological need satisfaction was developed by Ryan and Deci (2000). The revised version of the scale of Van Den Broeck et al. (2010) was used in this study. This scale consists of 18 items and uses a 5-point Likert scale to measure psychological factors. The scale response ranges from 1 ('Totally disagree') to 5 ('Totally agree'), with six items for autonomy satisfaction, six items for competence satisfaction, and six items for relatedness satisfaction. The questionnaire has the potential to measure satisfaction for three needs at work: 'Competence' need reflects satisfaction with effective teaching and feeling mastery of the work at hand; 'Autonomy' need reflects satisfaction with the degree of freedom in executing instructional activities; and 'Relatedness' need reflects satisfaction with meaningful relationships within the professional context. In summary, these three subcomponents of BNS measure intrinsic motivations that drive individuals to satisfy their basic needs at work.

An initial validation was conducted to confirm the consistency of the BNS-W scale's factor loadings in order to assess the scale's suitability for measuring teachers' satisfaction with autonomy, competence, and relatedness subcomponents in the Indian context. CFA results indicated that item 2 ("At work, I often feel like I have to follow other people's commands"), item 3 ("If I could choose, I would do things at work differently"), and item 6 ("In my job, I feel forced to do things I do not want to do") of the autonomy factor had very low factor loadings. Similarly, items 1 ("I don't really feel competent in my job") and 4 ("I doubt whether I can execute my job properly") of the competence factor also showed low factor loadings. Regarding the relatedness factor, item 1 ("I don't really feel connected with other people at my job") and item 3 ("I don't really mix with other people at my job") showed low factor loadings, with the latter being lower than 0.30 (DiStefano, 2002). Seven items were deleted from the original scale as the scales are reverse-coded items, which have the potential to confuse the respondent. This reduced the reliability of the scale when it was used in a different cultural context (Afulani, Diamond-Smith, Golub, & Sudhinaraset, 2017). There is a substantial improvement in the model fit with the removal of 7 items from the 11-item model. The χ^2 value decreased significantly from 827 to 85, and the degrees of freedom decreased from 132 to 41. The root mean square error of approximation (RMSEA) improved from .0894 to .0407. Additionally, the Comparative Fit Index (CFI) increased from .620 to .945, and the Tucker-Lewis Index (TLI) increased from .559 to .926. Therefore, the CFA results of the modified model of basic need satisfaction indicate that the 11-item CFA model fits the data well. The CFA results are presented in Table 2.

Van Den Broeck et al. (2010) had established Cronbach's alpha for the manifest scale, which were 0.81, 0.85, and 0.82, respectively, for autonomy, competence, and relatedness. In the current study, the Cronbach's α reliability coefficients for the three factors were 0.513 (autonomy), 0.617 (competence), and 0.509 (relatedness), indicating good internal consistency for all remaining items within each subscale. The overall Cronbach's alpha value for basic need satisfaction was 0.680, as shown in Table 3. The literature indicates that a moderate acceptable value for reliability ranges from 0.50 to 0.75 (Parsons, Kruijt, & Fox, 2019).

2.4. Procedure of Data Collection

The investigation is conducted in two stages: the pilot study as Phase I and the main study as Phase II. The Institutional Review Board's approval is obtained before data collection, with the IRB approval number CU:

RCEC/00632/04/24. The school heads are approached for further permission to involve secondary teachers as participants. Data collection letters are provided to the school heads for approval signatures.

A pilot study is conducted to assess the practicality and effectiveness of the data collection tools, to familiarize the investigator with the administration, scoring, and interpretation of the tools, and to establish the reliability of the scale for further use. Based on the inclusion criteria, volunteers who give consent are the participants. The questionnaire consists of closed questions with a Likert scale, which varies in different scales. Two scales have ratings ranging from 1 to 5, and the third scale has ratings from 1 to 9. Participants are also provided with a demographic information form. The duration for completing all three questionnaires is approximately 30 to 40 minutes, and the demographic form is completed in a single session. All individuals who complete the three survey questionnaires along with the demographic information are considered for the study. Out of 41 participants in the pilot study, data from nine participants were excluded due to incomplete answers, multiple responses for an item, or data not meeting the inclusion criteria. The researchers used data from 32 participants for the reliability analysis, conducted using Jamovi software (version 2.4.11), a statistical package for social sciences. The Cronbach's α for the twenty-first-century teaching-learning survey is 0.954, for the basic need satisfaction at work scale is 0.761, and for the teachers' sense of efficacy scale is 0.87, indicating acceptable reliability values for use in the main study.

Data collection for the main study follows the same procedure as the pilot study. The current study uses convenience sampling due to the researcher's feasibility, and data is collected from five South Indian states to include a larger population area. After collection, data cleaning, and removal of outliers are performed, resulting in 658 participant data points out of 672. This sample size exceeds the threshold for mediation and moderation analysis and is appropriate for conducting all required analyses of the study (Fritz & MacKinnon, 2007). Although the study scale established acceptable values for Cronbach's alpha reliability during the pilot study, the researchers obtained construct validity using confirmatory factor analysis (CFA) on all three scales of the study to establish model fit and test the hypotheses within this cultural context.

2.5. Ethical Consideration

This study follows strict ethical guidelines to ensure the confidentiality and security of participants' data. The collected data are maintained securely and are utilized only for this research. Participants' and participants' schools' anonymity are maintained throughout the study, and no identifying information is disclosed in the reporting of results.

2.6. Data Analysis

Based on the self-reported responses regarding instruction of twenty-first-century skills, basic need satisfaction, and teacher self-efficacy, the data were analyzed using Jamovi 2.4.11. Descriptive analysis, correlation matrix, mediation analysis, and moderation analysis were used to test the research hypotheses.

3. RESULTS

3.1. Hypothesis 1: Descriptive and Correlation Analysis

Among the three factors of basic need satisfaction, competency ($M = 21.1$, $SD = 2.40$) has the most positive scores, and autonomy ($M = 12.6$, $SD = 1.52$) scored the lowest. Among the main components, instruction of twenty-first-century skills ($M = 137.2$, $SD = 23.51$) scored the highest, and basic need satisfaction ($M = 50.0$, $SD = 4.29$) had the lowest positive score. Table 3 summarizes the descriptive and correlation study results.

Table 3. Mean, standard deviation, Cronbach's α , and correlation matrix between study variables and control variables.

Variables	Mean	SD	Cronbach's α	21CTL	BNS	TSE	Autonomy	Competence	Relatedness
21CTL	137.2	23.51	0.929	—					
BNS	050.0	4.29	0.680	0.130***	—				
TSE	068.3	8.31	0.830	0.245***	0.242***	—			
Autonomy	012.6	1.52	0.513	0.123**	0.617***	0.146***	—		
Competence	021.1	2.40	0.617	0.108**	0.815***	0.252***	0.298***	—	
Relatedness	016.4	1.95	0.509	0.058	0.714***	0.108**	0.212***	0.330***	—

Note: ** $p < 0.01$, *** $p < .001$, 21CTL- 21st century skill teaching learning, BNS-Basic Need Satisfaction, TSE-Teacher Self-Efficacy.

The above table presents the correlation of all the study variables. The BNS is significant and positively correlates with 21 CTL ($r = 0.130, p < .01$), and it shows a significant positive correlation with TSE ($r = 0.242, p < .001$). TSE significantly correlates with 21CTL ($r = 0.245, p < .001$), providing initial support for hypothesis 1. Additionally, among the three subcomponents, autonomy, competence, and relatedness, only autonomy and competence are correlated with 21CTL ($r = 0.123, p < .01$; $r = 0.108, p < .01$), and both are also correlated with TSE ($r = 0.146, p < .001$; $r = 0.252, p < .001$). Since these associations are statistically significant and show a positive direction, they indicate that teacher self-efficacy is likely to mediate fully with basic need satisfaction and its subcomponents in their association with 21CTL.

3.2. Hypothesis 2: Mediation Analysis Results

The influence of teacher self-efficacy was examined in relation to basic need satisfaction and instruction of twenty-first-century skills among secondary school teachers, and Table 4 summarizes these results of mediation analysis.

Table 4. Mediation of teacher self-efficacy (TSE) on the association between basic need satisfaction (BNS-W) and 21st century teaching learning (21CTL).

Mediation Association	Total		Direct		Indirect	
	β	SE	β	SE	β	SE
BNS \Rightarrow TSE \Rightarrow 21CTL	0.1300***	0.2118	0.0751	0.2127	0.0549***	0.0697
AUTONOMY \Rightarrow TSE \Rightarrow 21CTL	0.1229**	0.5980	0.0890*	0.5880	0.0339***	0.1630
COMPETENCE \Rightarrow TSE \Rightarrow 21CTL	0.1076**	0.3800	0.0490	0.3820	0.0586***	0.1290
RELATEDNESS \Rightarrow TSE \Rightarrow 21CTL	0.0576	0.4690	0.0315	0.4580	0.0261*	0.1230

Note: * $p < .05$, ** $p < .01$, *** $p < .001$ 21CTL- 21st century skill teaching learning, BNS-Basic Need Satisfaction, TSE-Teacher Self-Efficacy.

Among the four independent variables, the mediation variable teacher self-efficacy shows full mediation for basic need satisfaction and also with its subcomponent competence factor, whereas with the subcomponent autonomy factor, it shows partial mediation. The subcomponent relatedness factor shows no mediation.

This table represents the result of the mediation effect. The results indicate that autonomy is significant and positively related to 21CTL. It also confirms the mediation effect of TSE in the association between autonomy and 21CTL ($\beta = 0.1229, p < 0.01$), showing a partial mediation effect of TSE.

The examination of the total effect of TSE in the relationship between BNS and 21CTL confirms that the mediating effect ($\beta = 0.1300, p < 0.001$) is greater compared to the mediation effect of TSE in the association of competence with 21CTL ($\beta = 0.1076, p < 0.01$), indicating a full mediation effect of TSE. In contrast, in the relationship between the relatedness factor and 21CTL, TSE does not demonstrate any mediation effect ($\beta = 0.0576, p > 0.05$). The research hypothesis 2 was accepted, as the mediation effect of teacher self-efficacy between basic need satisfaction and the instruction of twenty-first-century skills shows full mediation. The mediation effect of teacher self-efficacy between the subcomponent autonomy and the instruction of twenty-first-century skills indicates partial mediation. Additionally, the mediation effect of teacher self-efficacy between the subcomponent competence and the

instruction of twenty-first-century skills shows full mediation. However, teacher self-efficacy exhibits no mediation effect with the subcomponent relatedness and the instruction of twenty-first-century skills.

3.3. Hypothesis 3: Moderation Analysis Results

To investigate how work experience moderates the association between basic need satisfaction and instruction of twenty-first-century skills among secondary school teachers, Table 5 summarizes the results of the moderation analysis.

Table 5. Moderation effect of work experience in the relationship between basic need satisfaction (BNS-W) and 21st century teaching learning (21CTL).

Components	Estimate	SE	Z	p
BNS	0.8234	0.261	3.155	0.002
Experience	-0.6948	1.167	-0.595	0.552
BNS * Experience	0.0414	0.287	0.144	0.885

Note: BNS-Basic Need Satisfaction, 21CTL-21 Century Skill Teaching Learning, Work-Experience- (0-5 years), (6-10 years), (11-20 years), (21-30 years), “*” is the interaction.

The main effect of basic need satisfaction on the instruction of twenty-first-century skills shows a statistically significant influence: (Beta (β) = 0.8234, SE = 0.261, p = 0.002, where p < 0.05), and higher satisfaction of basic needs is associated with greater instruction of twenty-first-century skills. The results of the main effect of work experience do not show a significant effect on instruction of twenty-first-century skills (Beta (β) = -0.6948, SE = 1.167, p = 0.552, where p > 0.05). However, the interaction effect between basic need satisfaction and work experience shows (Beta (β) = 0.0414, SE = 0.287, p = 0.885, where p > 0.05), indicating no statistical significance. This suggests that work experience does not moderate the relationship between basic need satisfaction and twenty-first-century skills instruction. Therefore, hypothesis 3 was rejected.

4. DISCUSSION

In the outcomes of the correlation between the three constructs, firstly, the correlation between basic need satisfaction and instruction of twenty-first-century skills is positively correlated with a weaker association. The study's positive findings are consistent with Self-Determination Theory, showing how the satisfaction of autonomy, competence, and relatedness promotes motivation and improves teaching effectiveness. Prior studies have supported this view, mentioning the role of autonomy in promoting prosocial behaviour (Stupnisky, BrckaLorenz, Yuhas, & Guay, 2018; Zhang, Lv, Jiang, Chen, & Luo, 2024). Competence improves instructional confidence, and relatedness improves teaching quality (Maas et al., 2022). Teachers need to have some level of autonomy in the workplace to demonstrate their competence, and for that, when a favorable environment is given, it encourages their optimal functioning. The school management has to establish a democratic working environment in which teachers exercise some level of accountability and independence to teach innovative pedagogy. The professional development and training must concentrate on offering innovative pedagogy-specific training to build teachers' competence to teach twenty-first-century skills. The authorities in the school also have to enhance internal capacities by providing scope for collaborative learning.

The second set of correlation analysis shows a weak positive relationship between basic need satisfaction and teacher self-efficacy, suggesting the limitation of mutual influence of two constructs despite their theoretical link. Self-Determination Theory and Social Cognitive Theory emphasize intrinsic motivation and efficacy, but this study indicates modest interaction with the practices. Basic need satisfaction is an internal satisfaction for institutional support, whereas teacher self-efficacy is a belief in task-specific performance (Zhou & Liu, 2025). Contextual factors like limited autonomy, professional stress, or inconsistent support may weaken this relationship (Vansteenkiste, Ryan, & Soenens, 2020). Teachers' self-efficacy in the school is essential for confidence in instruction. When it is associated

with the need satisfaction for autonomy, competence, and relatedness, teachers' functioning also becomes optimal. For that, professional training institutes need to focus on enhancing teachers' self-efficacy through various trainings and workshops. The third set of correlations between teacher self-efficacy (TSE) and instruction of twenty-first-century skills also reveals a weak positive association, contrasting Bandura's Social Cognitive Theory, which explains efficacy beliefs that strongly influence instructional behaviour. Though previous studies report a stronger association (Kholifah et al., 2023), the present study is consistent and aligns with it in a positive direction. This suggests that teacher self-efficacy may not be sufficient for effective instruction but instead may require familiarization with instructional skills, critical thinking, creativity, collaboration, communication, and technical skills, which might be useful for effective integration of it into the curriculum (Herlinawati, Marwa, Ismail, Liza, & Situmorang, 2024). Instruction in twenty-first-century skills requires a higher level of competence and confidence in teachers' abilities. When teachers gain competence in innovative skills, their confidence levels automatically increase. Therefore, professional development training should focus on providing training on specific twenty-first-century skills, including both theoretical and practical knowledge. This approach will enhance teachers' self-efficacy in instructing twenty-first-century skills. This association between the constructs is further explored for the mediation influence of the teacher self-efficacy, and it shows differential mediating influence in association with the sub-components of basic need satisfaction. Teacher self-efficacy fully mediates the relationship between basic need satisfaction and the instruction of twenty-first-century skills, specifically through the competence sub-component. This finding emphasizes that perceived competence in innovative pedagogy needs and also teachers' belief in their ability to teach effectively. These findings support prior research that argues competence and shows its influence on instruction when accompanied by a strong sense of efficacy (Chan, Maneewan, & Koul, 2023; Lauermaann & ten Hagen, 2021). Some other studies suggest that higher teachers' self-efficacy improves their ability to implement twenty-first-century skills effectively (Klaeijnsen, Vermeulen, & Martens, 2018; Yang & Du, 2024). Teachers' competence highly depends on the teacher's self-efficacy for effective instruction. Only when teachers' self-efficacy is enhanced will their instructional competence also improve. Professional training not only focuses on providing skill training to enhance competence but also needs to focus on strengthening teachers' self-efficacy through various self-efficacy-enhancing sessions and workshops. Teacher self-efficacy shows partial mediation with autonomy in its relationship to instruction of twenty-first-century skills. In this, autonomy shows a positive influence on teacher self-efficacy as well as a direct impact on instructional practices, suggesting that teacher self-efficacy has a partial mediation effect. Previous studies demonstrate that autonomy-supportive environments enhance teachers' self-efficacy and intrinsic instructional goals behavior (Cheon, Reeve, Lee, & Lee, 2018; Choi & Mao, 2021; Duchatelet & Donche, 2019). This partial mediation suggests possible complexities that influence motivation and belief in shaping innovative teaching practices. The findings also suggest that, apart from teacher self-efficacy, some other factors, like availability of resources, infrastructure, and specific training, could strengthen the effect on instruction. The school authorities need to consider the fact of improving the infrastructure of the school to support teachers with digital resources for the effective instruction of twenty-first-century skills.

For relatedness between the sub-components, teacher self-efficacy shows no mediation, which is surprising in the Indian context, where collectivistic values typically emphasize connection and collaboration (Abd Razak, Darmawan, & Keeves, 2010). Teachers are likely to put more effort into the teaching process when they are highly motivated, due to their feeling of sense of belonging (Matteucci et al., 2017). Though theoretically, relatedness is needed to foster motivation with a sense of belonging and professional interconnectedness (Allen, Kern, Rozek, McInerney, & Slavich, 2021), supportive relationships experience enhancing instructional efficacy (Gülsün, Malinen, Yada, & Savolainen, 2023; Wilson, Marks Woolfson, & Durkin, 2020). However, the findings of this study reflect the possibility of limited collegial support, authoritative leadership, or a lack of collaborative opportunities. This may be due to hierarchical culture, workload, and fewer opportunities for collaboration, which might have hindered the influence of relatedness (Ratnam, 2021). The development of innovative pedagogical skills requires continual updating, and support from

colleagues and ongoing professional training are essential. Collaborative environments and transformational leadership are necessary to activate and enhance relatedness among teachers for effective instructional practices.

In the final finding of work experience as a moderator, it does not alter the strength of the relationship between basic need satisfaction and instruction of twenty-first-century skills. This suggests that, regardless of years of experience, perceptions of autonomy, competence, and relatedness do not significantly alter their instructional approach to innovative instructional practices. These findings challenge earlier assumptions that experience enhances teachers' effectiveness and confidence (Layek & Koodamara, 2024). However, the findings of this study align with recent research emphasizing the importance of continuous professional development, openness to change, and digital adaptability (Caena & Vuorikari, 2022). This study argues that experience alone is insufficient for innovation in instruction, but it requires a growth-oriented mindset and adaptation to evolving skills that may better support effective integration of twenty-first-century skills in teaching. The school authorities need to arrange training to orient teachers on the innovative skill requirements and support teachers of all experience levels to provide training according to their learning pace and needs to enhance their confidence for innovative instruction, irrespective of their age and experience.

5. CONCLUSION AND IMPLICATIONS

This study examines the differential mediation effect of teacher self-efficacy on components of basic need satisfaction. The findings highlight the importance of teacher self-efficacy in fostering confidence in instructing twenty-first-century skills. While autonomy may not entirely depend on teacher self-efficacy, it functions independently and influences instructional ability. Relatedness, on the other hand, does not rely on teacher self-efficacy for instruction but may require additional professional support to effectively teach twenty-first-century skills. The absence of a moderation effect of work experience presents a novel perspective on this study. The implications suggest that the educational department should provide professional training on twenty-first-century skills to teachers at all levels, regardless of age and experience. Teachers should be given autonomous opportunities to implement various twenty-first-century instructional strategies. Training in self-efficacy can enhance teachers' confidence and instructional effectiveness. Additionally, a positive school environment is essential for fostering healthy relatedness, which can be improved through collaborative learning opportunities focused on twenty-first-century skills. Continuous training and regular mentoring support are necessary for teachers' professional development and upskilling. The study has a few limitations due to its cross-sectional design, as this research is exploratory in nature and cannot establish a consistent causal relationship between variables. Employing a longitudinal research design would provide greater clarity in confirming causal linkages over time. The quantitative survey questionnaire could not capture all the underlying influences, for which a qualitative research design can be suitable in future studies to understand the complexities of these interactions. The delimitations are that it has focused only on a few areas of India for research with a convenience sampling procedure, limiting the generalizability of the findings. The research can be extended to larger geographical areas with a stratified sampling procedure for better outcomes. Future studies can also involve stakeholders like students to confirm the effectiveness of instruction and school authorities for provisional support of resources and training, which provides holistic knowledge for the study.

Funding: This study received no specific financial support.

Institutional Review Board Statement: This study was approved by Institutional Review Board of the CHRIST University, India under protocol number (CU: RCEC/00632/04/24), dated 06 April 2024 with. Written informed consent was obtained from the participants.

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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